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## TRANSLATION

METHOD OF OBTAINING A HEAT-RESISTANT PARAMAGNETIC POLYMER

By

V. P. Parini and A. A. Berlin

FOREIGN TECHNOLOGY  
DIVISION

AIR FORCE SYSTEMS COMMAND

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FTD-TT-62-1882/1+4

# UNEDITED ROUGH DRAFT TRANSLATION

METHOD OF OBTAINING A HEAT-RESISTANT PARAMAGNETIC POLYMER

BY: V. P. Parini and A. A. Berlin

English Pages: 2

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7 July 1961, pp 1

S/19-62-0-13

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Date 26 Feb 19 63

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## METHOD OF OBTAINING A HEAT-RESISTANT PARAMAGNETIC POLYMER

V. P. Parini and A. A. Berlin

The familiar method for obtaining a heat-resistant paramagnetic polymer is the reaction of diamine with -p-benzoquinone or its halogen substitute which contains labile hydrogen or halogen atoms adjacent to the carboxylic oxygen.

The proposed method, compared to the familiar method, broadens the source of raw materials for obtaining a heat-resistant paramagnetic polymer. The distinguishing feature of this method is that aromatic diamine is subjected to reaction with quinone, free of labile hydrogen atoms adjacent to the keto group. The polymers thus obtained have increased heat resistance; their specific electrical conductance at  $25^{\circ}$  is  $10^{-9}$  to  $10^{-7}$  ohm $^{-1}$  cm $^{-1}$ , with conductance energy of 0.25 to 0.3 ev.

Example 1. A mixture of 2.7 g (0.05 meta position) of phenylene-diamine and 5.2 g (0.05 meta position) of anthraquinone is heated at  $300^{\circ}$  for 3 hours in a sealed ampoule in an inert atmosphere. The solid product of the reaction is crushed, washed by boiling alcohol,

dried, freed from the low-molecular-weight impurities, and kept at a temperature of  $200^{\circ}$  and a pressure of  $10^{-3}$  mm for 2 hours. The obtained product is black powder which is insoluble in alcohol, acetone, dioxane, and xylene, and which is partly soluble in pyridine, dimethylformamide, and 98% sulfuric acid. The product yield is 5.9 g. At elevated temperatures the obtained paramagnetic polymer undergoes a weight loss: at  $400^{\circ}$  - 2%, at  $500^{\circ}$  - 4%, at  $600^{\circ}$  - 7.5%.

Example 2. A mixture of 2.3 g (0.025 meta position) of benzidine and 2.6 g (0.025 meta position) of anthraquinone is subjected to a reaction as in Example 1. We obtain 3.3 g of a black powder which is insoluble in alcohol, partly soluble in acetone and dioxane, almost completely soluble in pyridine, dimethylformamide, and sulfuric acid, and soluble in 98% sulfuric acid (the solutions have a green color).

Rigid films can be obtained on evaporation of the organic solvents from the solutions. The obtained paramagnetic polymer undergoes the following weight losses with elevated temperatures: at  $300^{\circ}$  - 2%, at  $400^{\circ}$  - 5%, and  $500^{\circ}$  - 8%.

#### Object of the Invention

The method of obtaining a heat-resistant paramagnetic polymer by the reaction of diamine with quinone has the distinguishing feature that in order to expand the raw materials, aromatic diamine is subjected to a reaction with quinone, free of labile hydrogen atoms adjacent to the keto group.

# ORGANIC CHEMISTRY

## ASTIA

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		ALKYL	
OI		ALKANES	
21Q. I		1 IC	
3015, 25		2 2C	
1663, 25		3 3C	
3885, 25		4 4C	
0745, 25		5 5C	
3561, 25		6 6C	
2288, 25		7 7C	
2285, 25		8 8C	
3392, 25		9 9C	
33II, 25		10 IC	
1245, 5		11 10C	
0210, II	01 12	10+C	
0210, 14	02 0	TERMINAL	
0210, 12	1	NONTERMINAL	
0210, 13	2	POLY USAGE	

		ALKENES	
0210, 15		3 ALKENES	
3015, 5		4 =CH2	
1663, 75		5 C=C	
3885, 75		6 3C	
0745, 75		7 4C	
3561, 75		8 5C	
2288, 75		9 6C	
2285, 75		10 7C	
3392, 75	02 12	8C	
33II, 75	03 0	9C	
1247, 5	1	10C	
0210, 16	2	10+C	
0210, 20	3	TERMINAL	
0210, 17	4	NONTERMINAL	
0210, 18	5	POLY =	
0210, 19	6	POLY USAGE	

		ALKYNYL	
02II, 2		7 ALKYNES	
3015, 75		8 C≡C	
0022, 5		9 C≡C	
3906, 5		10 3C	
0747, 5	03 12	11 4C	
3565, 5	04 0	12 5C	
02II, 3	1	6+C	
02II, 7	2	TERMINAL	
02II, 4	3	NONTERMINAL	
02II, 5	4	POLY =	
02II, 6	5	POLY USAGE	

		ARYL	
0570, 10		6 BENZENE	
0570, 15		7 MONOSUB	
0570, 11		8 DISUB	
0570, 21		9 TRISUB	
0570, 16	04 12	10 ORTHO	
0570, 14	05 0	11 META	
0570, 17	06 0	12 PARA	
0570, 20	1	13 SYM-TRISUB	
0570, 19	2	14 POLYSUB	
0570, 13	3	15 IND	
0570, 12	4	16 FUSED	
0570, 18	5	17 POLY USAGE	

		CYCLOALKANES	
1225, 10		6 CYCLOALKANES	
1225, 11		7 3,4M	
1225, 12		8 5M	
1225, 13		9 6M	
1225, 14		10 7+M	
1225, 19	05 12	SAT	
1225, 21	06 0	UNSAT	
1225, 15	1	BICYCLO	
1225, 17	2	IND	
1225, 16	3	FUSED	
1225, 20	4	SPIRO	
1225, 18	5	POLY USAGE	

		HALOGENS	
2214		6 HALOGENS	
1883, 2		7 F	
0921, 5		8 Cl	
0724, 5		9 Br	
2586, 5		10 I	
0421	06 12	At	
2214, 5	07 0	POLY USAGE	

		CARBONYL	
0003, 7		I CARBONYL	
0803, 2		2 C=O	
1915, 5		3 HC=O	
5091, 6		4 C=S	
5091, 30		5 HC=S	
3468, 25		6 O=(RING)	
5090, 11		7 S=(RING)	
2982, 5		8 MET.CARBONYLS	
3461, 5		9 C-C	
0803, 5	07 12	POLY USAGE	
0803, 4	07 12	MISC.	

		COOR	
0804, 3	08 0	COOR	
0804, 1	1	-COO-ESTER	
0804, 2	2	COOH	
0804, 7	3	CARBOXY HALIDES	
0804, 6	4	F-C=O	
0804, 5	5	Cl-C=O	
0804, 4	6	Br-C=O	
0804, 8	7	I-C=O	
0804, 9	8	OCOO	
0182, 5	9	O-C-O-C	
0805, 25	11	METAL SALT	
0805, 75	08 12	POLY USAGE	
0805, 5	09 0	MISC.	

		S-COOR	
5090, 15		I S-COOR	
5090, 12		2 THIO ACIDS (CXXH)	
5091, 5		3 S=C-O	
5091, 4		4 O=C-S	
5090, 22		5 -S-COOH	
5090, 17		6 S=C- HALOGEN	
5090, 20		7 S=C- Br	
5090, 19		8 S=C- Cl	
5090, 18		9 S=C- F	
5090, 17		10 S=C- I	
5090, 14	09 12	POLY USAGE	
5090, 13	10 0	MISC.	

3297, 5	II	N, C, S
5090, 16	13 12	=N-C=S
1398, 75	14 0	-N-C(-S)-S
5091, 7	1	=N-(C=S)-N
5091, 20	2	-S-CN
2618, 5	3	-N=C=S
3297, 7	4	POLY USAGE
3297, 6	5	MISC.

3297, 2	6	N, C, O
4462, 5	7	NC(=O)-N-N
0785, 25	8	-N-C(=O)-O-
5361, 5	9	=N-C(=O)-N-
0785, 75	11	-C(=O)-N-
2613, 25	12	-N=C=O
1222, 5	15 0	-O-CN
3297, 4	1	POLY USAGE
3297, 3	2	MISC.

3297, 25	3	C, N
1223, 5	4	CN
2613, 75	5	-N=C
0239, 2	6	-N-C=N
2150, 5	7	-N-C(=N)-N-
0787, 5	8	-N=C=N-
0787, 5	9	POLY USAGE
0787, 5	11	MISC.

2391, 6	15 12	OH, SH
2391, 4	16 0	OH
2968, 25	1	SH
2391, 8	2	POLY USAGE

2391, 27	3	N, O (S)
2391, 2	4	=N-OH
2968, 75	5	=N-SH
3295, 5	6	NO2
3299, 75	7	-N=O
3299, 25	8	-N=N-C
3289, 5	9	N=NO2
3298, 29	11	POLY USAGE
3298, 27	16 12	MISC.

4863, 25	17 0	S, O (N)
4860, 75	1	O=S=O
4860, 25	2	SO3H
4859, 5	3	S=O
4860, 5	4	SO2-N
4863, 27	5	POLY USAGE
4863, 26	6	MISC.

3468, 75	17	O, S
3587, 5	18	S=O
5090, 10	19	SO3H
1398, 25	20	N=O
5257, 5	21	SO2-N
3475, 28	22	POLY USAGE



# C CHEMISTRY

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### S - HETERO

NS	4863.10	1	S-HETERO
	4863.14	2	3, 4M
	4863.15	3	SM
	4863.16	4	6M
	4863.17	5	7+M
USAGE	4863.21	6	O-CONT.
	4863.20	7	N-CONT.
	4863.22	8	OTHER-CONT.
	4863.11	9	IS
	4863.12	11	2S
	4863.12	10	3+S
	4863.19	11	IND
	4863.18	1	FUSED
	4863.24	2	SPIRO
	4863.23	3	POLY USAGE

### N - HETERO

3298.10	4	N-HETERO
3298.14	5	3, 4M
3298.15	6	SM
3298.16	7	6M
3298.17	8	7+M
3298.20	9	O-CONT.
3298.23	11	S-CONT.
3298.21	12	OTHER-CONT.
3298.11	0	IN
3298.12	1	2N
3298.13	2	3+N
3298.24	3	SALT
3298.19	4	IND
3298.18	5	FUSED
3298.25	6	SPIRO
3298.22	7	POLY USAGE

### O-HETERO

3475.10	8	O-HETERO
3475.13	9	3, 4M
3475.14	11	5M
3475.15	12	6M
3475.16	13	7+M
3475.19	1	N-CONT.
3475.22	2	S-CONT.
3475.20	3	OTHER-CONT.
3475.11	4	I-O
3475.12	5	2+O
3475.18	6	IND
3475.17	7	FUSED
3475.23	8	SPIRO
3475.21	9	POLY USAGE

### N, C, S

3297.5	II	N, C, S
5090.16	13	-N-C=S
1398.75	14	-N-C(=S)-S
	0	=N-C(=S)-N
5001.7	1	-S-CN
5001.20	2	-N=C=S
2618.5	3	POLY USAGE
3297.7	4	MISC.
3297.6	5	

### N, C, O

3297.2	6	N, C, C
4462.5	7	NC(=O)-N-N-
0785.25	8	-N-C(=O)-O-
5361.5	9	=N-C(=O)-N-
0785.75	11	-C(=O)-N-
2613.25	14	-N=C=O
1222.5	15	O-CN
	0	MISC.

### C, N

0797.25	3	C, N
1223.5	4	CN
2613.75	5	-N=C
0239.2	6	-N-C=N
2150.5	7	-N-C(=N)-N-
0787.5	8	-N=C=N-
0797.75	9	POLY USAGE
0797.5	II	MISC.

### OH, SH

2391.6	15	OH, SH
2391.4	16	OH
2968.25	1	SH
2391.8	2	POLY USAGE

### N, O, (S)

3298.27	3	N, O (S)
2391.2	4	=N-OH
2968.75	5	=N-SH
3295.5	6	NO2
3299.75	7	-NO
3299.25	8	-N=N-C
3289.5	9	N-NO2
3298.29	II	POLY USAGE
3298.27	16	MISC.

### S, O, (N)

4863.25	17	S, O (N)
4860.75	1	O=S=O
4860.25	2	SO3H
4859.5	3	S=O
4860.5	4	SO2-N
4863.27	5	POLY USAGE
4863.26	6	MISC.

### O, S

3468.75	8	O-
3587.5	9	-O-O-
5090.10	II	-S-
1398.25	17	-S-S-
5257.5	18	-S-S-S-
3475.29	1	POLY USAGE
	2	MISC.

### AMINES

0239.5	3	AMINES
3882.5	4	NH2-(PRI)
4442.5	5	NH-(SEC)
5036.5	6	-N-(TER)
3884.5	7	-N-(QUAT)
2442.5	8	=N
0503.5	9	-N=N-
1329.5	11	N≡N (N≡N=)
2359.5	12	-N-N-
5251.5	19	N=N-N-
0501.5	1	N=N

### METALS AND METALLOIDS

2140	24	0	GROUP I
0205	1		ALKALI
0877	2		Cs
1925	3		Fr
2787	4		L
3808	5		K
4592	6		Na
4365	7		Rb
1134	8		Cu
2102	9		Au
4542	II		Ag

### PHOSPHORUS

1883.4	2	FLUOROAMINES
1883.8	3	-NF2
1883.6	4	-NF
1884.5	5	F2N-NF-
0239.5	6	SALT (NON-QUAT)
0239.9	7	POLY USAGE
0239.7	8	MISC.

### PHOSPHORUS RAD.

3634.2	9	PHOSPHORUS RAD.
3634.16	II	P=O,S,O
3634.18	19	P=S,ZO
3634.17	20	P=O, S, ZO
3634.19	1	S=PO3
3634.15	2	S=P-F
3634.14	3	S-P-F
3634.11	4	O-P(N)(O)-F
3634.10	5	O-P(F)2N
3634.13	6	O=P(F)O2
3634.12	7	O-P-F
3634.23	8	P,S-(I TO 3S)
3634.24	9	P,S-(4S)
1224.75	II	CYCLIC P
3632.25	20	P(+3)
3632.75	21	P(+5)
3617.5	1	PO4
3634.21	2	P-MISC.
3634.25	3	P,S-MISC.
3634.22	4	POLY USAGE

### BORANES

0687	5	BORANES
4530	6	SILANES

### MISCELLANEOUS

22	23	
0	0	
1	1	
2	2	
3	3	
4	4	
5	5	
6	6	
7	7	
8	8	
9	9	
II	II	
12	12	

### CHALCOGENS

2145	9	CHALCOGENS
0883	II	Po
3781	27	Sr
4457	28	Cr
0935	1	Bi
3122	2	N
5277	3	P
4956	7	Ta
5381	8	V

### TRANS. ELEM.

2146	4	TRANS. ELEM.
5223	5	Co
0992	6	In
2604	7	Fr
2607	8	K
3276	9	Ni
3456	II	Os
3492	28	Pd
3744	29	Pr
4277	1	Rh
4373	2	Ru



**FRAGMENT RELATIONSHIPS**

<b>ALKYL</b>	<b>ALKENYL</b>	<b>ALKYNYL</b>	<b>ARYL</b>	<b>CYCLOALKYL</b>
30 0 ARYL	11 ARYL	8 ARYL	6 ARYL	4 CYCLOALKYL
1 CYCLOALKYL	31 12 CYCLOALKYL	9 CYCLOALKYL	7 CYCLOALKYL	5 HALOGENS
2 HALOGENS	32 0 HALOGENS	11 HALOGENS	8 HALOGENS	6 CARBONYL
3 CARBONYL	1 CARBONYL	33 12 CARBONYL	9 CARBONYL	7 COOR
4 COOR	2 COOR	34 0 COOR	11 COOR	8 S-COOR
5 S-COOR	3 S-COOR	1 S-COOR	35 12 S-COOR	9 S-HETERO
6 S-HETERO	4 S-HETERO	2 S-HETERO	36 0 S-HETERO	11 N-HETERO
7 N-HETERO	5 N-HETERO	3 N-HETERO	1 N-HETERO	12 O-HETERO
8 O-HETERO	6 O-HETERO	4 O-HETERO	2 O-HETERO	38 0 N,C,S
9 N,C,S	7 N,C,S	5 N,C,S	3 N,C,S	1 N,C,O
II N,C,O	8 N,C,O	6 N,C,O	4 N,C,O	2 C,N
30 12 C,N	9 C,N	7 C,N	5 C,N	3 N,O(S)
31 0 N,O(S)	11 N,O(S)	8 N,O(S)	6 N,O(S)	4 OH, SH
1 OH, SH	32 12 OH, SH	9 OH, SH	7 OH, SH	5 S,O(N)
2 S,O(N)	33 0 S,O(N)	11 S,O(N)	8 S,O(N)	6 O,S
3 O,S	1 O,S	34 12 O,S	9 O,S	7 AMINES
4 AMINES	2 AMINES	35 0 AMINES	11 AMINES	8 PHOSPHORUS
5 PHOSPHORUS	3 PHOSPHORUS	1 PHOSPHORUS	36 12 PHOSPHORUS	9 METALS
6 METALS	4 METALS	2 METALS	37 0 METALS	11 BORANES
7 BORANES	5 BORANES	3 BORANES	1 BORANES	38 12 SILANES
8 SILANES	6 SILANES	4 SILANES	2 SILANES	39 0 MISC.
9 MISC.	7 MISC.	5 MISC.	3 MISC.	
<b>S-HETERO</b>	<b>N-HETERO</b>	<b>O-HETERO</b>	<b>N,C,S</b>	<b>N,C,O</b>
44 0 S-HETERO	4 N-HETERO	7 O-HETERO	9 N,C,S	11 N,C,O
1 N-HETERO	5 O-HETERO	8 N,C,S	11 N,C,O	48 12 C,N
2 O-HETERO	6 N,C,S	9 N,C,O	47 12 C,N	49 0 N,O(S)
3 N,C,S	7 N,C,O	11 C,N	48 0 N,O(S)	50 C
4 N,C,O	8 C,N	46 12 N,O(S)	1 OH, SH	
5 C,N	9 N,O(S)	47 0 OH, SH	2 S,O(N)	
6 N,O(S)	11 OH, SH	1 S,O(N)	3 O,S	
7 OH, SH	45 12 S,O(N)	2 O,S	4 AMINES	
8 S,O(N)	46 0 O,S	3 AMINES	5 PHOSPHORUS	
9 O,S	1 AMINES	4 PHOSPHORUS	6 METALS	
II AMINES	2 PHOSPHORUS	5 METALS	7 BORANES	
44 12 PHOSPHORUS	3 METALS	6 BORANES	8 SILANES	
45 0 METALS	4 BORANES	7 SILANES	9 MISC.	
1 BORANES	5 SILANES	8 MISC.		
2 SILANES	6 MISC.			
3 MISC.				
<b>O,S</b>	<b>AMINES</b>	<b>PHOSPHORUS</b>		
52	O,S	52 12 PHOSPHORUS		
6 AMINES	53 0 METALS	4 METALS		
PHOSPHORUS	1 BORANES	5 BORANES		
7 METALS	2 SILANES	6 SILANES		
8 BORANES	3 MISC.	7 MISC.		
9 SILANES				
II MISC.				
<b>RING SYSTEM (GENERAL)</b>	<b>RING INDEX NO.</b>	<b>RING INDEX NAME</b>		
4292. 2	6 RINGS-2	56 57 58 59		
4292. 4	7 RINGS-3	0 0 0 0		
4292. 5	8 RINGS-4	1 1 1 1		
4292. 7	9 RINGS-5	2 2 2 2		
4292. 9	11 RINGS-6+	3 3 3 3		
3298. 29	54 12 N-RINGS-1	4 4 4 4		
3298. 30	55 0 N-RINGS-2	5 5 5 5		
3298. 31	1 N-RINGS-3+	6 6 6 6		
4863. 28	2 S-RINGS-1	7 7 7 7		
4863. 29	3 S-RINGS-2+	8 8 8 8		
3475. 24	4 O-RINGS-1	9 9 9 9		
3475. 25	5 O-RINGS-2+			
3089. 25	6 MISC.-HETERO RINGS-1			
3089. 75	7 MISC.-HETERO RINGS-2			



## **FRAGMENT RELATIONSHIPS**

	<b>ARYL</b>	<b>CYCLOALKYL</b>	<b>HALOGENS</b>	<b>CARBONYL</b>	<b>S-COOR</b>	<b>COOR</b>
. KYL	6 ARYL	4 CYCLOALKYL	1 HALOGENS	CARBONYL	II COOR	S-COOR
IS	7 CYCLOALKYL	5 HALOGENS	2 CARBONYL	8 COOR	4I 12 S-COOR	42 12 S-HETERO
'L	8 HALOGENS	6 CARBONYL	3 COOR	9 S-COOR	42 0 S-HETERO	43 0 N-HETERO
II	9 CARBONYL	7 COOR	4 S-COOR	II S-HETERO	1 N-HETERO	1 O-HETERO
CO	10 COOR	8 S-COOR	5 S-HETERO	40 12 N-HETERO	2 O-HETERO	2 N,C,S
35 12	36 0 S-COOR	9 S-HETERO	6 N-HETERO	4I 0 O-HETERO	3 N,C,S	3 N,C,O
10	1 N-HETERO	II N-HETERO	7 O-HETERO	I N,C,S	N,C,O	4 C,N
10	2 O-HETERO	37 12 O-HETERO	8 N,C,S	2 N,C,O	C,N	N,O (S)
10	3 N,C,S	38 0 N,C,S	9 N,C,O	3 C,N	N,O (S)	OH, SH
	4 N,C,O	1 N,C,O	II C,N	N,O (S)	OH, SH	S,O (N)
	5 C,N	3 C,N	12 N,O (S)	OH, SH	S,O (N)	5 O,S
	6 N,O (S)	3 N,O (S)	39 OH, SH	4 S,O (N)	4 O,S	6 AMINES
	7 OH, SH	4 OH, SH	40 0 S,O (N)	O,S	5 AMINES	7 PHOSPHORUS
	8 S,O (N)	5 S,O (N)	I O,S	AMINES	6 PHOSPHORUS	8 METALS
	9 O,S	6 O,S	2 AMINES	5 PHOSPHORUS	7 METALS	9 BORANES
	II AMINES	7 AMINES	3 PHOSPHORUS	6 METALS	8 BORANES	II SILANES
	36 12 PHOSPHORUS	8 PHOSPHORUS	4 METALS	7 BORANES	9 SILANES	43 12 MISC.
	36 12 METALS	9 METALS	5 BORANES	8 SILANES	II MISC.	
	37 0 METALS	II BORANES	6 SILANES	9 MISC.		
	1 BORANES	38 12 SILANES	7 MISC.			
	2 SILANES	39 0 MISC.				
	3 MISC.					

	[N,C,S]	[N,C,O]	[C,N]	[N,O(S)]	[OH, SH]	[S,O(N)]
RO	9 N,C,S 11 N,C,O 47 12 C,N 48 0 N,O(S) 1 OH, SH 2 S,O(N) 3 O,S 4 AMINES 5 PHOSPHORUS	II N,C,O 48 12 C,N 49 0 N,O(S) 1 OH, SH 2 S,O(N) 3 O,S 4 AMINES 5 PHOSPHORUS 6 METALS 7 BORANES 8 SILANES 9 MISC.	II C,N 49 12 N,O(S) 50 0 OH, SH 1 S,O(N) 2 O,S 3 AMINES 4 PHOSPHORUS 5 METALS 6 BORANES 7 SILANES 8 MISC.	N,O(S) OH, SH 9 S,O(N) O,S II AMINÉS 50 12 PHOSPHORUS 51 0 METALS 1 BORANES 2 SILANES 3 MISC.	51 4 OH, SH S,O(N) O,S 5 AMINES 6 PHOSPHORUS 7 METALS 8 BORANES 9 SILANES II MISC.	S,O(N) S,O(N) 52 0 AMINES 1 PHOSPHORUS 2 METALS 3 BORANES 4 SILANES 5 MISC.
DURUS	6 METALS 7 BORANES 8 SILANES 9 MISC.					
S						

<b>AMINES</b>	<b>PHOSPHORUS</b>	<b>METALS</b>	<b>BORANES</b>	<b>SILANES</b>	<b>MISC.</b>
AMINES	53	8 METALS	54 0 BORANES	54 3 SILANES	54 5 MISC.
52 12 PHOSPHORUS	PHOSPHORUS	9 BORANES	I SILANES	4 MISC.	
53 0 METALS	4 METALS	II SILANES	2 MISC.		
I BORANES	5 BORANES	53 12 MISC.			
2 SILANES	6 SILANES				
3 MISC.	7 MISC.				

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